

## REMARKS

Applicants respectfully request consideration of this application.

As a preliminary matter, the undersigned made a provisional election to prosecute the invention of Group I claims 1 – 18 during a telephone conversation with Examiner Lam on May 16, 2005. Applicant hereby affirms the election of Group I claims 1 – 18 and Group II claims 19 – 29 are canceled without prejudice.

### Office Action Objections and Rejections Summary

The drawings have been objected to for failing to comply with 37 C.F.R. 1.84(p)(4). Claims 1, 8, and 10 have been rejected under 35 USC § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Claims 1, 2, and 9 have been rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,872,453 to Arnaud et al. (hereinafter “Arnaud”). Claims 1 and 2 have been rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,229,514 to Larson (hereinafter “Larson”). Claims 1 – 2, 6, 9 – 13 and 18 have been rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 4,922,242 to Parker (hereinafter “Parker”). Claims 1 – 18 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Parker or Arnaud or Larson in view of U.S. Patent No. 6,880,396 to Rait (hereinafter “Rait”).

### Status of Claims

Claims 1 – 18 remain pending in this application. Claims 1, 8, and 10 have been amended. The amendments are supported by the specification and no new matter has been added. Claims 19 – 29 have been canceled without prejudice. No new claims have been added. Applicant reserves all rights with respect to the Doctrine of Equivalents.

### Drawing Objections

The drawings have been objected to for failing to comply with 37 C.F.R. 1.84(p)(4). Appropriate amendments have been made to the specification (as discussed above) for minor typos in the detailed description to correct for inconsistencies with the drawings as originally filed. Applicant respectfully submits that replacement drawing sheets are not required. As such, the drawings objections have been overcome and applicant respectfully requests removal of the objection.

### 35 U.S.C. § 112 Rejections

Claims 1, 8, and 10 have been rejected under 35 USC § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Appropriate amendments have been made to claims 1, 8, and 10 and as such, applicant respectfully requests removal of the rejection.

### 35 U.S.C. § 102(e) and 35 U.S.C. § 102(b) Rejections

Claims 1, 2, and 9 have been rejected under 35 USC §102(e) as being anticipated by Arnaud. Claims 1 and 2 have been rejected under 35 U.S.C. 102(b) as being anticipated by Larson. Claims 1 – 2, 6, 9 – 13 and 18 have been rejected under 35 U.S.C. §102(b) as being anticipated by Parker. Applicant respectfully submits that claims 1, 2, and 9 are patentable over Arnaud, claims 1 and 2 are patentable over Larson, and claims 1 – 2, 6, 9 – 13, 18 are patentable over Parker.

Amended independent claim 1 provides:

An apparatus, comprising:

a carrier substrate having a visible surface and a heat generating component coupled to the carrier substrate; and

a thermochromatic material disposed adjacent to the carrier substrate, ***the thermochromatic material to produce a visual change of the visible surface when an activation temperature of the thermochromatic material is reached to indicate an area of the carrier substrate that is above an operating temperature caused by a***

***dissipation of heat from the heat generating component.***

(emphasis added)

Amended independent claim 10 provides:

A printed circuit board, comprising:

- a signal layer coupled to a heat generating component;
- a solder mask layer disposed above the signal layer; and
- a thermochromatic layer disposed adjacent to the solder mask layer, ***the thermochromatic layer to change a visible surface of the printed circuit board from a first visible state to a second visible state to indicate an area of the printed circuit board that is above an operating temperature caused by a dissipation of heat from the heat generating component.*** (emphasis added)

Arnaud discloses a glazing coated with a thermochromatic layer. In particular,

Arnaud includes the following disclosure:

The main aim of such a layer is to be able to cause the thermochromic layer or layers to switch by heating using these conducting layers provided with suitable means of connection to a supply of electricity. The conducting layer heats up by resistance heating when it is supplied with electricity, and it transmits this heat to the thermochromatic layer in order to make it switch to its reflecting/absorbent state when required. Many variants are possible. It is possible to adjust the level of electrical conductivity at the conducting layer (chemical nature, type of doping, thickness, etc.), according to the type of thermochromic layer used (switch temperature raised or lowered by doping, etc.) and according to the respective positions of the conducting layer and the thermochromic layer. As an example, it is possible to use metal layers, such as Ag layers, having a thickness ranging from 5 to 50 nm, especially 8 to 30 nm. An ITO layer may have a thickness ranging from 50 to 500 nm, especially 100 to 300 nm.

(col. 6, lines 1 – 16)

Nothing in Arnaud discloses or suggests that the thermochromatic layer is used to show a dissipation of heat from a heat generating component coupled to a carrier substrate or printed circuit layer. In fact, there is no disclosure in Arnaud that the thermochromatic layer is disposed over a carrier substrate or printed circuit layer.

In contrast, amended independent claim 1 includes the limitation of, “the

thermochromatic material to produce a visual change of the visible surface when an activation temperature of the thermochromatic material is reached to indicate an area of the carrier substrate that is above an operating temperature caused by a dissipation of heat from the heat generating component.” As such, applicant respectfully submits that independent claim 1 is patentable over Arnaud and request removal of the rejection under 35 USC §102(e). Claims 2 and 9 each depend either directly or indirectly from independent claim 1 and thus include the limitation of, “the thermochromatic material to produce a visual change of the visible surface when an activation temperature of the thermochromatic material is reached to indicate an area of the carrier substrate that is above an operating temperature caused by a dissipation of heat from the heat generating component.” Accordingly, dependent claim 2 and 9 are also patentable over Arnaud under 35 USC §102(e).

Larson discloses a display device for visualizing computer generated image formation. In particular, Larson includes the following disclosure:

According to a preferred embodiment shown in FIG. 10, the matrix 1 consists of a double-sided circuit board or film, where the board/substrate consists of a semiconductor material 2 and the electrodes on both sides of the board/substrate are of the printed circuit board type. The temperature sensitive indication material 8a is arranged in the visualization medium 8, which may be integrated within the matrix 1.

(col. 6, lines 53 – 60, and Figure 10)

Nothing in Larson discloses or suggests that the temperature sensitive indication material is used to show a dissipation of heat from a heat generating component coupled to a carrier substrate or printed circuit layer.

In contrast, amended independent claim 1 includes the limitation of, “the thermochromatic material to produce a visual change of the visible surface when an activation temperature of the thermochromatic material is reached to indicate an area of the

carrier substrate that is above an operating temperature caused by a dissipation of heat from the heat generating component.” As such, applicant respectfully submits that independent claim 1 is patentable over Larson and request removal of the rejection under 35 USC §102(b). Claim 2 depends directly from independent claim 1 and thus include the limitation of, “the thermochromatic material to produce a visual change of the visible surface when an activation temperature of the thermochromatic material is reached to indicate an area of the carrier substrate that is above an operating temperature caused by a dissipation of heat from the heat generating component.” Accordingly, dependent claims 2 is also patentable over Larson under 35 USC §102(b).

Parker discloses a resistive element adjacent to a thermochromatic layer for displaying information. In particular, Parker includes the following disclosure:

In other embodiments, the apparatus of the invention may comprise timing mechanisms such as clocks or bimetallic switches used to turn the display on or off at appropriate times. These timing mechanisms are particularly useful for blanking signs, i.e. signs which display a single message at specified times or under specified conditions but remain blank or opaque at other times. For these signs, the first electrode and the second electrode are frequently the same pattern because only a single message is displayed. A single first and a single second electrical lead are required so that when they are connected to a suitable power supply, current flows through the resistive element and thus selectively generates heat therein in a pattern used to display the message. The use of a reversible thermochromic material allows repetitive display of the information.

(col. 6, lines 49 – 65)

Nothing in Parker discloses or suggests that the thermochromic material is used to show a dissipation of heat from a heat generating component coupled to a carrier substrate or printed circuit layer.

In contrast, amended independent claim 1 includes the limitation of, “the thermochromatic material to produce a visual change of the visible surface when an

activation temperature of the thermochromatic material is reached to indicate an area of the carrier substrate that is above an operating temperature caused by a dissipation of heat from the heat generating component.” Similarly, amended independent claim 10 includes the limitation of, “the thermochromatic layer to change a visible surface of the printed circuit board from a first visible state to a second visible state to indicate an area of the printed circuit board that is above an operating temperature caused by a dissipation of heat from the heat generating component.” As such, applicant respectfully submits that independent claims 1 and 10 are patentable over Parker and request removal of the rejection under 35 USC §102(b).

Claims 2, 3, 6, and 9 each depend either directly or indirectly from independent claim 1 and thus include the limitation of, “the thermochromatic material to produce a visual change of the visible surface when an activation temperature of the thermochromatic material is reached to indicate an area of the carrier substrate that is above an operating temperature caused by a dissipation of heat from the heat generating component.” Claims 11 – 13 and 18 each depend either directly or indirectly from independent claim 10 and thus include the limitation of, “the thermochromatic layer to change a visible surface of the printed circuit board from a first visible state to a second visible state to indicate an area of the printed circuit board that is above an operating temperature caused by a dissipation of heat from the heat generating component.” Accordingly, dependent claims 2, 3, 6, 9, 11 – 13 and 18 are also patentable over Parker under 35 USC §102(b).

### 35 U.S.C. § 103(a) Rejections

Claims 1 – 18 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Parker or Arnaud or Larson in view of Rait. Independent claim 1 includes the limitation of, “the thermochromatic material to produce a visual change of the visible surface when an

activation temperature of the thermochromatic material is reached to indicate an area of the carrier substrate that is above an operating temperature caused by a dissipation of heat from the heat generating component.” Independent claim 10 includes the limitation of, “the thermochromatic layer to change a visible surface of the printed circuit board from a first visible state to a second visible state to indicate an area of the printed circuit board that is above an operating temperature caused by a dissipation of heat from the heat generating component.” As discussed above, nothing in Parker, Arnaud. or Larson discloses or suggests these limitations.

Rait discloses a thermochormic leucodye ink level indicator. In particular, Rait includes the following disclosure:

In particular, the level indicator 10 of the present invention is structured in such a manner that when the level indicator 10 is in a heat transfer relationship with a heat transfer-inducing agent, at least one of the at least two leucodye inks 32 is the level indicator 10, in the region of the interface 20 between the liquid 16 and the void volume 18 above it within the container 14 and having an operating temperature range encompassing the temperature of the heat transfer-inducing agent, will exhibit a profound color change responsive to heat transfer between the heat transfer-inducing agent and the liquid 16 so as to permit the level of the interface 20 to be detected. Typically, the heat transfer-inducing agent is chosen from the group consisting of hot air, cold air, steam, hot liquid, cold liquid.

(col. 12, lines 27 – 41)

Nothing in Rait discloses or suggests that the leucodye ink is used to show a dissipation of heat from a heat generating component coupled to a carrier substrate or printed circuit layer. As such, Rait fails to cure the deficiencies of Parker, Arnaud, and Larson.

It is respectfully submitted that Parker or Arnaud or Larson and Rait do not teach or suggest a combination with each other. It would be impermissible hindsight, based on applicant’s own disclosure, to combine Parker or Arnaud or Larson and Rait.

Applicant also respectfully submits that there is no motivation to combine Parker or Arnaud or Larson and Rait. The Office Action states, "In view of the prior art teachings, one skill[ed] in the art would [change] the arrangement slight[ly] and choose leucodye ink, liquid crystal or N-isopropylacrylamide as a thermochromatic material because the arrangement can be [modified] according to one's desire and these claimed thermochromatic materials exhibit color changes upon changes in temperature" (05/27/2005 Office Action, page 7, lines 7 – 15). Here, the Office Action merely states an advantage of substituting the ink from Rait into the mechanisms of Parker, Arnaud, or Larson without explaining what specific understanding or technological principle within the knowledge of one of ordinary skill in the art would have suggested the combination. In particular, one of ordinary skill in the art would not look to thermochromic inks disposed on containers for use in carrier substrate or printed circuit board mechanisms.

Even if Parker or Arnaud or Larson and Rait were somehow combined, the combination would still not include all the limitations of independent claims 1 and 10, and in particular, the claim 1 limitation of "the thermochromatic material to produce a visual change of the visible surface when an activation temperature of the thermochromatic material is reached to indicate an area of the carrier substrate that is above an operating temperature caused by a dissipation of heat from the heat generating component," and the claim 10 limitation of, "the thermochromatic layer to change a visible surface of the printed circuit board from a first visible state to a second visible state to indicate an area of the printed circuit board that is above an operating temperature caused by a dissipation of heat from the heat generating component." As such, applicant respectfully submits that independent claims 1 and 10 are patentable over Parker or Arnaud or Larson and Rait under 35 U.S.C. §103(a) and request removal of the rejection. As claims 2 – 9 depend from claim 1 and claims 11 – 18 depend from claim 10, dependent claims 2 – 9 and 11 – 18 are also



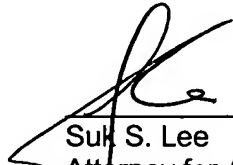
patentable over Parker or Arnaud or Larson and Rait.

In conclusion, applicant respectfully submits that in view of the arguments set forth herein, the applicable rejections have been overcome. If the Examiner believes a telephone interview would expedite the prosecution of this application, the Examiner is invited to contact Suk Lee at (408) 720-8300. If there are any additional charges, please charge our Deposit Account No. 02-2666.

Respectfully submitted,

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